Assessment of fetal well being with observation of different fetal movement types

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With the development and application of real time ultrasound B-scanning in obstetrics, it has become possible to observe fetal behavior noninvasively in utero. Since behavior represents the output of the central nervous system (CNS), the development and functional integrity of this system can be studied, both from the standpoint of developmental physiology and for monitoring fetal condition in clinical practice.

Early pregnancy. Observation of fetal motility up to about 20 weeks' gestation is facilitated by the fact that the entire fetus can be visualized within the field of one ultrasound transducer. Recently a detailed description of the movement patterns exhibited by the young fetus has been provided, together with the timetable of their appearance during development (1). Moreover, observation of these movement patterns provided convincing evidence that they are both spontaneous and well organized.

Alternation between periods of more and less frequent movements develops early. A clustering of movements can be detected as early as 9 weeks' gestation. From about 14 weeks, the short term clustering of movements is replaced by longer epochs of fluctuating activity. Periods during which gross movements were absent were found to last usually about 5 minutes, but rest periods of up to 14 minutes were observed (1).

Several authors have described absent or decreased fetal movements in pregnancies which subsequently ended in spontaneous abortion. In one large series "infrequent" movements - that is, fewer than 3 movements in 10 to 15 minutes - were observed in 131 of the 4313 cases studied (2). The incidence of subsequent abortion in these pregnancies, 34%, was more than 8 times greater than that in the women with more frequent fetal movements. On the other hand, the majority of these fetuses with infrequent movements (66%) were born at term, so that the proportion of false abnormal predictions was high. The relatively short observation period employed - 10 to 15 minutes - together with the pauses in fetal motility which are present from 9 weeks onward (1), may have contributed to this lack of predictive value. Also, attention to the character and quality of the movements may improve the accuracy of prediction of the status of the young pregnancy.

Experience is presently too limited to say whether observation of movement patterns can be used to identify abnormal fetuses - for example, trisomies. It may be that the sequence in which movement patterns appear during development may be delayed or disturbed in such cases.

Late pregnancy. After 20 weeks' gestation it is no longer possible to visualize the entire fetus with one real time ultrasound transducer. It is nonetheless possible to recognize certain

distinct types of somatic movements: gross rolling movements involving the trunk, head and all extremities; stretches including retroflexion of the head plus movement of the extremities; isolated retroflexions of the head; and extremity movements. Facial movements which can be identified include mouth movements, sucking and swallowing. Fetal eye movements can also be identified.

Real time ultrasound observation of fetal movements is a very useful addition to the techniques for fetal surveillance in late pregnancy. Echoscopic observation of fetal breathing movements, somatic movements and muscle tone have been combined with assessment of amniotic fluid volume and the unstressed CTG in a "biophysical profile" (3). The combination of variables improved the predictive ability for perinatal morbidity, as might have been expected; but the presence of even one normal variable decreases the incidence of antepartum death and perinatal mortality.

With regard to the individual types of fetal movements, absence of fetal breathing movements and absence of fetal somatic movements seem to have about equal value in predicting intrapartum fetal distress, low Apgar scores and perinatal mortality (3, 4). The incidence of breathing movements is reduced in growth retarded fetuses (5, 6), but because of the discontinuous nature of fetal breathing movements and the large number of physiologic factors affecting them, this is not very helpful in diagnosis. In many growth retarded fetuses the body movements appear to be weaker and slower than those of normal fetuses, and this does not seem to be entirely due to the relative oligohydramnios often present in these cases. Facial movements, including mouth movements, appear to be the last to go in the presence of fetal distress, so that the presence of these movements in the absence of other fetal motilities is not reassuring.

All of the types of fetal motility which have been studied exhibit alternation between periods of presence and absence. Even in the young preterm fetus, there is a certain degree of linkage between the separate variables, so that if a particular variable is in the active or "on" condition, other variables are also more likely to be "on" than "off" (Table 1).

Table 1. Association of fetal motilities. (Values = mean % ± SD)

	32 weeks				38 weeks			
	Breathing movements		Eye movements		Breathing movements		Eye movements	
	+	-	+	-	+	-	+	-
Body movements +	67±18	33±18	77±12	23±12	76±24	24±24	86±12	14±12
Body movements -	45±35	55±35	37±25	63±25	51±37	49±37	17±18	83±18

(+, present; -, absent) (P between all vertical pairs, 0.05, Wilcoxon test)

After about 36 to 37 weeks, the linkage between the variables becomes much more pronounced, and behavioural states analogous to those described in the newborn infant (7) can be detected (8) (Table 2).

Table 2 Fetal Behavioural States (8).

Variable	State 1F	State 2F	State 3F	State 4F
Heart rate	Stable, no or narrow oscillations	Oscillating, accelerations	Stable, wider oscillations than 1F	Large, fused accelarations
Body movements	Incidental	Periodic	Absent	Continuous
Eye movements	Absent	Present	Present	Present
Fet.Breathing*	Regular	Irregular	--	Irregular

*State concomittant, not continually present

Fetal behavioural states are included here because they represent a new aspect of "fetal neurology", and provide another means of assessing the function of the fetal CNS. In the normal fetus, these states begin to appear at 36 weeks and are uniformly present at 38 weeks (8). Once developed, they normally remain present until delivery; however, disorganization of previously present states has been observed in a postterm infant which subsequently exhibited marked hyperirritability. Additional research is necessary to determine whether disturbances in the development and organization of behavioural states might be a useful indicator that high risk pregnancies should be terminated without waiting for the classical CTG signs of serious fetal hypoxia. Furthermore, observation of fetal behaviour in utero might aid in distinguishing CNS disfunction present before birth from that acquired as a result of intrapartum asphyxia or trauma.

Conclusions. Real time ultrasound scanning, by allowing observations of several types of fetal motility, permits an assessment of the function of the fetal CNS. Disturbance of CNS function should be detectable in advance of serious asphyxial distress, providing for improved management decisions in the care of the threatened fetus.

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